CLEMSON

IMPACTS

Old genes, new promise

CLEMSON UNIVERSITY PUBLIC SERVICE & AGRICULTURE - FALL 2013




Master Pest Control
Junior Beef Round Up
Cogongrass
Intelligent Farm

Vice President's Message

Just short of a hundred years ago – the centennial anniversary is May 8, 2014 – a pair of Southern legislators ignited a revolution in education.

Sen. Hoke Smith of Georgia joined Rep. Frank Lever of South Carolina to fashion the Smith-Lever Act of 1914, which created the national Cooperative Extension Service.

Support for Smith-Lever was overwhelming: The bill passed the U.S. House of Representatives with a mere seven dissenting votes. Individual states enthusiastically adopted the measure, establishing nearly 3,000 Extension offices across the country.

The impact of Extension has been even greater than the enthusiasm for it. The advanced farming methods developed by land-grant university research and extended to farmers has helped raise the income and improve the lives of countless rural families. And it has produced the diverse, inexpensive and abundant food supply we all enjoy today.

Countries across the globe have tried to copy the system. Some are still trying, as international visits attest (page 15).

Daily in South Carolina, Clemson Cooperative Extension lives up to its name – cooperating with local, state and national agencies to share research and educational resources with citizens across the state.

It's in that spirit of practical innovation that Clemson's Lever Initiatives were created (page 12). Named for Frank Lever, a Clemson University trustee as well as a S.C. congressman, the Lever Initiatives set the stage for the next wave of innovations to extend knowledge beyond our campus: professional development, online education and certification programs to strengthen our state's agricultural and environmental enterprises.

You'll also see how the century-old Extension education philosophy works today to prepare for tomorrow – and how this work dovetails with research and regulatory programs in Clemson's unified approach to public service and agriculture.

A series of stories (page 8) highlights the work of Clemson regulatory personnel who license pesticide applicators and ensure the health of South Carolina's plant and animal industries. That their work is fully integrated into our land-grant university mission is summed up in the statement: Regulation through Education.

Highlights of some of the research that fuels our educational mission (page 13) include work to build an "intelligent farm" that provides farmers with real-time data on a wide variety of variables.

From efforts to improve the genetics of South Carolina cattle herds (page 3) to the hands-on field days that give farmers an up-close-and-personal view of crop advancements (page 6), our faculty and staff continue to live up to the vision that Frank Lever and Hoke Smith committed to law a century ago.

Thank you for letting us share some of these stories with you.

Sincerely,

John W. Kelly

John Kelly
Vice President for Economic Development

See videos online: www.clemson.edu/impacts

CLEMSON
PUBLIC SERVICE AND AGRICULTURE

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Famous bloodline, Favorable future

By Tom Hallman

When you start selling cattle to Texans you can bet your tall hat you're on to something big in the beef business.

Clemson's sale this fall of a $25,000 bull to a Texas ranch is important for more than just bragging rights. It's one step on a long road toward rebuilding a herd of Herefords that once provided a teaching, research and Extension platform for improving cattle genetics on South Carolina farms.

"It's a story that goes back more than 80 years," said Brian Bolt, an animal scientist with both teaching and Extension duties at Clemson, who directs the development of the herd.

The bull on his way to the Lone Star State – with the memorable moniker "Battle Rupert T-352" – is part of a line of Herefords with long Clemson ties. Bolt can trace the bull's lineage to the famous Trask cattle that originated in South Carolina when polled Herefords, as a breed, were newly developed from their older, horned cousins.

Neil Trask of Calhoun Falls assembled the herd during the Great Depression, envisioning a breed that would lift the fortunes of a sinking cotton economy. From Trask's genetics, Clemson assembled a teaching herd of its own – a base from which to help other farmers strengthen the productivity and efficiency of their cattle.

"These Herefords are uniquely adapted to Southeastern conditions," Bolt said. "At the end of the day, they just work. It comes back to the type of cattle these are."

Brian Bolt unfolds a chart of bloodline of Battle Rupert T-352.

Those characteristics include heat tolerance, a docile nature that makes them easy to work with and, perhaps most important for the Southeast, fescue tolerance. Polled Herefords are capable of eating large volumes of forage, even if it has a comparatively low nutritional value, and still gain weight.

Over decades, the Hereford herd at the university was scattered and sold, until Steve Meadows, a lifelong cattleman and Extension animal scientist, saw the need to rebuild a grass-based Hereford herd at Clemson. As a teenager, Meadows had bought a pair of Hereford heifers from Fowken Farms in Jonesville, which had close ties to Trask, for a 4-H project. It would launch his career in the study of cattle. Decades later, he approached the Fowler family in an effort to rebuild the university herd.

Fowken Farms' Norris Fowler, Randy Owen of Tennessee River Music and Teddy Gentry of Bent Tree Cattle Company helped provide four cows in the Trask line from which Meadows harvested embryos.

Bolt now directs that herd. "We're rebuilding. We have a vision of establishing a teaching and Extension herd – one with Southeastern genetics and all the trappings that go along with that," he said.

*See **Bloodline** page 5*

Different forage affects beef cattle weight, taste

By Peter Kent

Cattle are what they eat. The forage – grasses and other plants – beef cattle eat affects the nutrition and tastiness of the meat.

Clemson animal science researchers report that steers grazing on one of five forages kept in paddocks showed significant differences in growth, carcass and meat quality.

The research can help cattle producers with alternatives to corn and feed when they are looking to add weight and value to their animals prior to sale.

The research found that finishing on legumes (alfalfa and cowpea) increased carcass quality, and in taste tests consumers preferred the flavor of the meat. Finishing on bermuda grass and pearl millet improved the levels of healthy fatty acids that may reduce cancer risks.

"The study is useful to beef producers in the Southeast, where summer heat is a challenge for finishing cattle," said John Andrae, a forage and pasture specialist. "These forages have potential to boost steer growth and quality when traditional cool-season forages are either dormant or have slow growth rates and don't do as good a job finishing cattle for market."

Learn more about livestock and forages:
www.clemson.edu/extension/livestock/

The working man's bull test

By Tom Hallman

Before you make a big investment, you put the product to the test.

It's true of an appliance or a new car. It's also true of a bull.

For decades, Clemson Extension, like land-grant universities across the country, has held bull tests to help cattle producers identify bulls – and bloodlines – that will yield efficient weight gain.

"The idea is that the genetic traits of the bull will be passed along to its offspring," said Scott Sell, a Clemson Extension agent who directs the forage bull test sale at Clemson's Edisto Research and Education Center. "You're looking for efficiency in how that animal gains weight. The difference in our test is in where they're getting the nutrition to put on that weight."

The Edisto test differs from others in the bulls' diet. While most tests feed them grain, Edisto offers bulls merely what they will get when they start to work on the farm: pasture grass.

Beginning with an appetizer of Tift 85 Bermuda grass, the bulls munched through the test on similar grasses that are common Southeastern cattle diets, with side dishes of a little alfalfa hay and other occasional treats. But they didn't enjoy large doses of corn or other grains to fatten them up.

Edisto staff (left-to-right) Harry McAlhany, Gillian Tuttle, Scott Sell.

"It's more real-world conditions," said Keith Hawkins of Hawk's Nest Ranch, who breeds angus cattle in Hickory Grove, S.C., and enters bulls in the Edisto test regularly. "Bulls from the forage test are a lot more stable. When you leave with them, they don't melt like a stick of butter when you get them home."

"When the bulls leave here they are ready to work," Sell said. "Cattle genetics have improved over the years to the point they've become more efficient on grass. That makes a test like this even more important."

Bulls at the Edisto test registered an average daily weight gain of 2.66 pounds, "really good for a forage test," Sell said.

"We had a phenomenal year as far as grazing was concerned. It couldn't have been better," he said. "The bulls came in here averaging 671 pounds and left averaging 1,250. We doubled their weight with absolutely nothing out of a bag. People can take those genetics home and know that they're going to perform."

Learn more about the Edisto Forage Bull Test:
www.clemson.edu/extension/livestock/livestock/beef/bull_tests/efbt.html

South Carolina Junior Beef Round-Up

Learn more about the Junior Beef Roundup:
www.clemson.edu/extension/livestock/beef/junior_beef/

Learning the trade of stock

A fine blend of art and science go into preparing a 50-pound youngster to lead a 500-pound animal through the show ring.

Teaching both is among the aims of the South Carolina Junior Beef Roundup, held each August for 4-H and FFA members and their families at Clemson's T. Ed Garrison Livestock Arena.

Judges observe and instruct young people in working with beef cattle and in the craft of "showmanship" – one of the building blocks of the trade of raising and selling beef cattle.

In addition to showmanship competition, young people are afforded opportunities to earn awards, savings bonds and even college scholarships in a variety of contests aimed at teaching the skills needed in the business. Breed Shows, the Junior Cattlemen's Contest, South Carolina Beef Ambassador Contest and even a Sales Talk Contest round out the event.

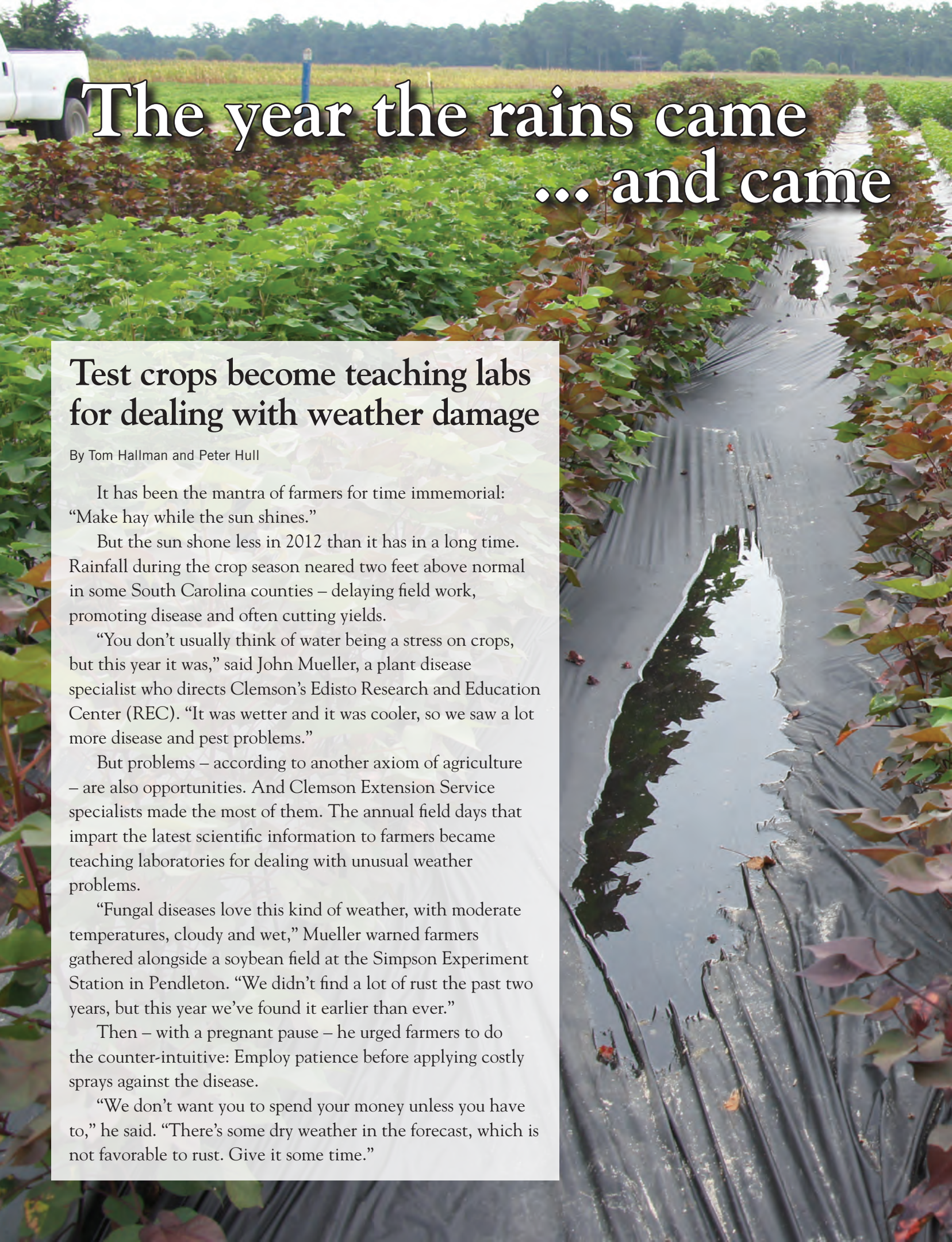
***Bloodline from** page 3*

In the few years the Herefords have bred at the Simpson Station a few miles from the Clemson campus, the results have been attention-grabbing. In addition to the sale of Battle Rupert to Texas, the university has sold bull semen from the Herefords to ranches as far away as Uruguay.

But it is South Carolina where Bolt, who grew up on an Anderson County family farm, has focused his attention.

"These cattle can help us demonstrate the impact a good breeding program can have on a farmer's ability to produce economical, profit-making animals on forage," he said. "That's the bottom line."

Learn more about Clemson beef programs:
www.clemson.edu/extension/livestock/beef/



The year the rains came ... and came

Test crops become teaching labs for dealing with weather damage

By Tom Hallman and Peter Hull

It has been the mantra of farmers for time immemorial: "Make hay while the sun shines."

But the sun shone less in 2012 than it has in a long time. Rainfall during the crop season neared two feet above normal in some South Carolina counties – delaying field work, promoting disease and often cutting yields.

"You don't usually think of water being a stress on crops, but this year it was," said John Mueller, a plant disease specialist who directs Clemson's Edisto Research and Education Center (REC). "It was wetter and it was cooler, so we saw a lot more disease and pest problems."

But problems – according to another axiom of agriculture – are also opportunities. And Clemson Extension Service specialists made the most of them. The annual field days that impart the latest scientific information to farmers became teaching laboratories for dealing with unusual weather problems.

"Fungal diseases love this kind of weather, with moderate temperatures, cloudy and wet," Mueller warned farmers gathered alongside a soybean field at the Simpson Experiment Station in Pendleton. "We didn't find a lot of rust the past two years, but this year we've found it earlier than ever."

Then – with a pregnant pause – he urged farmers to do the counter-intuitive: Employ patience before applying costly sprays against the disease.

"We don't want you to spend your money unless you have to," he said. "There's some dry weather in the forecast, which is not favorable to rust. Give it some time."

Such were the lessons to be learned in Clemson's fields across the state, from cotton and tobacco in Florence to watermelons and peanuts in Blackville.

Mother Nature proved she could vex the most knowledgeable farmers – including the researchers who have devoted their lives to the science of South Carolina agriculture.

"We planted our corn pretty much on schedule, but we've had problems ever since it came out of the ground — problems the likes of which I haven't seen before," David Gunter, an Extension corn and soybean specialist, told farmers at the Pee Dee REC in Florence.

"It came out of the ground and just stopped," he said. "Eventually the weather got better and the corn came on, but if you have a disease book on corn you'll find just about anything in it in this field."

Farmers cruised the crops at Clemson's research centers and looked for answers from the scientists who study them.

"We're not as row-crop oriented in the Piedmont any more, so most of our row-crop faculty are in Edisto and Pee Dee," said Garland Veasey, director of research farm services and host of the Simpson station's 2012 field day, which drew its largest crowd in a quarter century.

"It's good for the row crop farmers up here to have this one-on-one time with the Extension specialists and researchers from other stations," said Veasey, who re-routed some of his field day tours to avoid soggy sections of research fields.

In the midst of all the talk about rain, researcher Todd Campbell explained how he was trying to create a drought for his cotton crop.

The scientist with the USDA Agricultural Research Service is studying the effect of drought on the length of cotton fibers at the Pee Dee REC – information he hopes will lead to genetic advances that will help farmers grow more marketable cotton even when the rains fail.

During the unprecedented wet growing season, Campbell devised a solution to maintain a drought even in the face of unexpected rainfall.

"We laid down plastic mulch that is used for strawberry production to keep the soil dry. We've been monitoring moisture and we're approaching drought conditions, believe it or not," Campbell said. "At the end of the season we'll be able to determine drought effect on fiber length and the genetic targets we need for breeding programs."

Plant diseases encompass much of the research at the Pee Dee center. In between raindrops, Shyam Tallury, a new peanut breeder with the Advanced Plant Technology program, introduced farmers to wild peanut varieties he is using to breed new varieties that are resistant to common diseases.

The same holds true for research in tobacco.

"Our research is all designed to reduce disease and increase profitability," said Bruce Fortnum, a plant disease specialist and former director of the Pee Dee center. "Economic development has been the mission of the Pee Dee center since its beginning more than 100 years ago. Our research focuses on helping South Carolina farmers achieve greater profitability from the crops we can grow best in this region."

Learn more about Clemson's Research & Education Centers: www.clemson.edu/public/rec/

Our First Line of Defense

Something is always out there. At any given moment, an invasive plant, a devastating disease or an unseen insect can threaten our homes, our farms, our livestock or our livelihood.

This is when we turn to our front-line defenders: the regulatory professionals assigned to identify the threats and help keep us safe from attack.

At Clemson, the Regulatory Services and Livestock and Poultry Health divisions keep a watchful eye on plants, animals and the chemicals used to protect them. Unseen to most of us, they monitor the spread of potential pests through the state, inspect businesses that trade in plant material and meat and poultry products, and license the professionals who apply pesticides.

Officials with the Department of Plant Industry, Department of Pesticide Regulation, Animal Health Programs and Meat and Poultry Inspection must be able both to spring into action in an emergency and maintain ongoing prevention programs to protect farmers and the public.

Here are a few recent examples.

Traps create an early-warning system for a nearly invisible pest

By Tom Hallman

At less than 2 millimeters long, the walnut twig beetle might seem a meager opponent to a black walnut tree. Yet the petite pest can topple a 130-foot hardwood.

Native to the American West, the tiny bug originally fed on Arizona walnut, but developed a taste for black walnut as it spread east.

And that's why Olivia Souther has spent her summer planting and regularly checking traps amid the branches of black walnut trees across South Carolina.

"Walnut twig beetles have never been detected here, but recently have been found in North Carolina, so we believe they are on their way," said Souther, a senior biological sciences major who worked as an intern this summer for the Department of Plant Industry, a regulatory arm of Clemson that helps protect the state from plant pests and diseases.

"This was the first year we trapped for walnut twig beetle," she said. "We identified other insects of the same genus in these traps, but I'm surprised we didn't find it."

Detecting an invasive pest is the first step in controlling it; once it appears, it is both an environmental and an economic issue.

The black walnut trees the beetle attacks produce a nut that is prized in certain ice creams and confections. The quality of its wood also makes it valuable for furniture and other products.

Although the beetle is potentially devastating, it isn't easy to locate.

"They are very tiny," said Sarah Morrison, who coordinated the walnut twig beetle trapping program. "They burrow into the bark in the small twigs of the tree, which is why the beetles are so hard to find. Unless you are climbing into the top of the tree and cutting limbs, it's hard to find them. That's why we try to trap them."

The walnut twig beetle carries with it a secret weapon: a fungus, *Geosmithia morbida*, which causes a fatal disease in the tree.

"You wouldn't think something this small would hurt a big tree, but they're a vector for disease," Morrison said. "As they bore through the bark they carry the disease with them. The cankers disrupt the movement of nutrients in the tree. It actually chokes off the tree."

Aptly named "thousand cankers disease," it is usually first noticed in the tree's crown, where the beetles tend to burrow. Leaves will start to die in a tell-tale sign that the uppermost twigs and limbs of the black walnut tree aren't getting the nutrition they need.

Souther checked 29 traps in a dozen counties across the state, from Pickens to Dorchester, every week for six weeks. The traps included a scent to lure the bugs and then capture them in a liquid solution. Souther extracted the captured insects and sent likely suspects back to the lab for identification.

"We found close relatives, but not our pest of concern," said Sherry Aultman, Clemson's Cooperative Agricultural Pest Survey coordinator.

Learn more about invasive species: www.clemson.edu/invasives.

Officials conduct search for invasive weed discovered in Beaufort

By Tom Hallman

Don't let the pretty flower fool you: Benghal dayflower has a nasty tendancy to infest important crops.

Officials with the Department of Plant Industry confirmed the discovery of Benghal dayflower for the first time in South Carolina – nestled in a Beaufort homeowner's yard – leading them to conduct a house-to-house survey for the weed in November, concentrating their search in waterfront neighborhoods where the first sightings were made.

"We've been looking for it for years," said Christel Harden, assistant department head who leads the department's effort to curb the spread of regulated plant pests. "We expected to find it in a soybean field and found it someone's yard instead."

Benghal dayflower – which bears the alias "tropical spiderwort" and an official name of *Commelina benghalensis* – is regulated by both the state and federal governments as a noxious weed.

Benghal dayflower grows a dense stand that can smother other plants. It is a particular pest of row crops like soybeans, peanuts and corn.

That's a special concern in South Carolina, where row crops are a significant part of the economy. Soybeans, grown on 370,000 acres in the state, generated $182 million at harvest last year. Peanuts earned another $138 million.

"Benghal dayflower is a significant problem in Round-up Ready crops, because it is tolerant to many herbicides, including glyphosate," Harden said. "In Georgia, it's caused a lot of problems on soybeans and cotton. That's where the weed is typically found and that's where we've been looking."

The occurrence in Beaufort was detected by a landscaper who reported it to Clemson Extension Agent Laura Lee Rose. A Clemson lab confirmed the find.

This is the first time the weed has been found in the state outside of a plant nursery. Regulators found Benghal dayflower in a container with a liriope at a South Carolina nursery in 2005, where it was destroyed.

Native to tropical Asia and Africa, Benghal dayflower was discovered Florida in 1928 and earned its place on the Federal Noxious Weed List in 1983. It has spread across the South from Georgia to Louisiana.

Learn more about Benghal dayflower: www.clemson.edu/public/regulatory/plant_industry/pest_nursery_programs/invasive_exotic_programs/

Learn more about the Invasive Species Program: www.clemson.edu/invasives

Increase in mosquito-borne disease keeps equine industry vigilant

By Peter Kent

At a measly 3 milligrams, the common mosquito seems an unlikely match for a thousand-pound horse.

But each year, mosquitos bearing deadly viruses infect dozens of horses in South Carolina, claiming equine lives and threatening humans as well.

Boyd Parr, South Carolina State Veterinarian and director of Clemson's Livestock-Poultry Health unit, leads the fight against such threats as Eastern Equine Encephalitis (EEE) and the West Nile virus – two diseases that can affect humans as well as horses.

According to Parr's official count, a wet year and burgeoning mosquito population brought 49 cases of EEE in 2013 – more than three times the number a year before – and three cases of West Nile. Nearly half the counties in the state reported infections.

"These numbers are a vivid reminder of the threat that mosquito-borne diseases represent to horses in our state." he said. "Maintaining protection by vaccinating horses is important every year."

Parr urges horse owners to consult with their veterinarians to be sure vaccinations against both EEE and West Nile are up-to-date – an important p[recaution in a state with more than 80,000 horses valued at more than a third of a million dollars.

The EEE virus is maintained in nature through a cycle involving the freshwater swamp mosquito Culiseta melanura, commonly known as the blacktailed mosquito. Two to three days after becoming infected with EEE virus, a mosquito becomes capable of transmitting the virus. Infected mosquitoes that feed on both birds and mammals can transmit the disease to horses and humans.

Any livestock (including horses) that display neurologic signs – stumbling, circling, head pressing, depression or apprehension – must be reported to the state veterinarian at 803-788-2260 within 48 hours, according to the state law.

Learn more about Livestock-Poultry Health: www.clemson.edu/lph

Wanted!

Plant regulatory officials seek an invasive villain

By Tom Hallman

When law enforcement sought desperados in the Old West, they turned to one of the most effective tools of their trade: the "Wanted" poster.

Today, with especially desperate criminals, they use a wanted poster about 14 feet tall.

Billboards across South Carolina this year identified the outlaw: Cogongrass, an invasive weed that threatens local ecosystems and poses a significant fire threat.

"It's a nasty pest, a noxious weed," said Steve Compton, an environmental health manager with the Department of Plant Industry (DPI), a part of Clemson University's regulatory division. "The billboards allowed us to show the public precisely what it looks like so they can help us locate it."

Compton and his DPI colleagues recruit volunteers to help identify Cogongrass, an Asian native that had found its way to 12 of South Carolina's 46 counties, four of which are now free of the pest thanks to Clemson's eradication efforts.

"Cogongrass choke out even the most hardy native plants," Compton said. "It can easily displace native plants that are used by birds, animals and insects for forage, host plants and shelter. When its leaves turn brown in the winter, it also can create a substantial fire hazard. This stuff is like gasoline."

It spreads both through its small seeds and by creeping rootstalks called rhizomes, which can be transported by machines like tilling equipment. Across the South, some surveys have shown it as pervasive as kudzu.

"The economic impact of this pest is extensive," said Sherry Aultman, who coordinates Clemson's Cooperative Agricultural Pest Survey program. "It disrupts native habitats for other vegetation that is food for livestock and wildlife. It

interferes with prescribed burns in forestry. Nothing will eat Cogongrass, so it has no benefit whatsoever."

Clemson maintains a Web site – www.clemson.edu/cafls/cogongrass – with information and a way to report Cogongrass infestations online.

"We want to protect our state from invasive species like Cogongrass that are both economic and ecological threats," Compton said. "Alert citizens are an important component in keeping us safe."

But Compton cautions that, unlike many historic wanted posters, the Cogongrass billboards don't call for citizens to return the villainous vegetation "dead or alive."

"It's very difficult to destroy and attempts to do so can wind up spreading it further, so we ask that the public alert us to its presence so that we can effectively eliminate it," he said. "We want to take special precaution to make certain that when we find it, we eradicate it."

Learn more about Cogongrass:
www.clemson.edu/cafls/cogongrass

Learn more about the Clemson Invasive Species Program:
www.clemson.edu/invasives

Master pest control technicians get the upper hand on bugs

By Tom Hallman

It's a class most Clemson students will never choose to take. But homeowners can be happy their local pest control operators signed up.

The Master Pest Control Technician Course draws pest management operators to Clemson each summer for an intensive five-day course in pest management and insect identification.

The course blends face-to-face lectures from Clemson urban entomology faculty with hands-on laboratory exercises that include insect collections and identification, application technology and inspection procedures.

Like any college class, homework assignments and tests are part of the bargain. In lab assignments, students are tasked to identify species of bugs by examining various body parts or egg sacs under a microscope.

"The smokybrown cockroach is especially tough to identify," confessed Pat Zungoli, a Clemson Extension specialist in urban entomology and professor in the School of Agriculture, Forestry and Environmental Sciences. "It has characteristics that resemble other species in many respects.

"The distinction is somewhat sophisticated, but we call this a 'master' class for a reason," she said. "It speaks to the level of professionalism that these pest control technicians have achieved."

The annual class was created for general pest control technicians, sanitarians and in-house pest control professionals for schools, industrial sites and homes.

It's an elective, not a requirement for pest control technicians; however, it does yield credits toward their recertification.

More than 150 pest control operators have completed the master class in the past 14 years, said Clemson Extension entomologist Eric Benson.

"It's an intensive one-week course – definitely not for the feint of heart," Benson said. "It's top-level training and it's been really popular. Most of the large companies have their own in-housed training, but that still leaves hundreds of smaller firms that don't have the technical expertise for this level of training. For them, this is education they couldn't get elsewhere."

Learn more about the Clemson's urban entomology program online:
www.clemson.edu/cafls/departments/esps/research/urban

Look for the license when engaging pest control

By Tom Hallman

The war rages on as it has for time immemorial: Ravenous bugs relentlessly assail your home, lawn and garden.

Thankfully, you can fight back with troops who are licensed to kill.

"Most homeowners probably aren't aware that any commercial turf and landscape maintenance professional who applies any weed killer, insecticide or fungicide as part of his business must possess an approved South Carolina pesticide applicator's license," said Joe Krausz, head of the Department of Pesticide Regulation at Clemson University.

"If used improperly, pesticides can be dangerous to humans, pets and the environment. Children can be especially sensitive to certain pesticides if precautions are not followed," Krausz said. "The pesticide licensing process ensures that the pest control professional has passed a qualifying examination evaluating the applicator's knowledge about using pesticides safely, and that the applicator carries adequate liability insurance to cover mishaps that may occur due to the pest control activities."

Identifying a properly licensed applicator is easy: Look for a bright yellow decal – in the shape of the state of South Carolina – on both sides of his vehicle, stamped with the words "South Carolina Certified Commercial Pesticide Applicator."

Applicators who transport pesticides in their vehicles are required to display the decal.

"Before you sign a contract for lawn and landscape care, ask to see the lawn care professional's license," Krausz said. "The licensed individual may supervise an unlicensed applicator, but someone in the company must be properly licensed."

Learn more about the Department of Pesticide Regulation
www.clemson.edu/public/regulatory/pesticide_regulation

Intelligent Farm aims to help farmers' decision-making

By Peter Kent

For centuries, farmers managed their crops by picking up handfuls of soil, walking fields looking for insects or disease, and watching the weather.

In the digital age, there's a new row to hoe. Computers, satellites, field sensors and cell towers can provide real-time information to improve decision-making and enhance farm prosperity, environmental sustainability and food security.

Welcome to the Intelligent Farm®.

Clemson researchers are working to create the Intelligent Farm to provide the latest tools to growers and consultants, such as Clemson Extension agents and specialists, who can make better-informed decisions about where and how much water and fertilizer are needed.

Funded in part by the Clemson Experiment Station with resources from the USDA National Institute of Food and Agriculture, and the state of South Carolina, researchers with Clemson's Institute of Computational Ecology expect to realize dramatic benefits. Previous research on targeted applications has shown savings of 15 percent savings for water and 25 percent for energy, leading to increased farm profits.

Nitrogen, an essential fertilizer, poses a special challenge. Industrially produced nitrogen fertilizer is costly to both farmers and the environment if overused. Sensor-based, site-specific application at variable rates can reduce nitrogen use by 47 percent — 75,200 tons — and save S.C. farmers $30 million, Intelligent Farm researchers say.

At the Edisto Research and Education Center in Blackville, agricultural engineer Ahmad Khalilian is one of the lead scientists for this project. A pioneer in precision agriculture, Khalilian developed the concept of variable-rate nematicide application based on soil type. Using global positioning systems (GPS) linked to soil electrical-conductivity meters, the technology enables farmers to apply nematicides only where needed. The destructive microscopic worms cause more than $300 million in cotton crop losses each year.

The Intelligent Farm is a spinoff from Clemson's Intelligent River® initiative. The National Science Foundation awarded $3 million to Clemson in 2011 to develop and deploy a network of sensors to monitor water quality along the 312-mile length of the Savannah River.

Learn more about the Intelligent Farm: www.clemson.edu/public/ecology/project_ifarm.htm

Alex Holbrooks catching fireflies

Study shows need for conservation to preserve vanishing *fireflies*

By Peter Kent

Fireflies, an icon of Southern summers, are fewer and harder to find in some communities because of urban development and changes in forestry practices.

Results from a 2013 firefly count by Clemson scientists show there's a steady glow in many parts of the state, but conservation efforts are needed.

"We definitely need to protect them before it is too late," said biogeochemist Alex Chow, who launched the Vanishing Firefly Project with Clemson entomologist Juang-Horng "JC" Chong.

The goal of the program is to collect several years of data from different habitats across South Carolina and other states to determine the population trends of fireflies, often considered a bellwether for the environment.

Short-term results are encouraging. "It is too early to make a conclusion from one year of data," Chow said. "However, this year's data showed us many areas in South Carolina still have good population of fireflies."

The researchers are investigating the impacts of human activity on the abundance of fireflies. They are analyzing data for potential relationships between land-use patterns, soil quality and firefly abundance.

Because researchers cannot be physically present everywhere fireflies appear, they sought help from citizen-scientists.

In a June 1 statewide firefly survey, volunteers reported observations using the project web page or a wireless app produced by computer science associate professor Roy Pargas and graduate student Doug Edmonson.

Learn more about the Clemson Vanishing Firefly Project: www.clemson.edu/public/rec/baruch/firefly_project
See firefly map: firefly.clemson.edu

Ditch redesign draws on data from a digital age

By Peter Kent

Even ditch digging requires some college education these days. What was once a product of strong backs, picks and shovels, now involves PhDs, computers, digital mapping and a return to nature.

Hydrologist Anand Jayakaran, stationed at Clemson's Baruch Institute of Coastal Ecology and Forest Science in Georgetown, researches both natural and developed watersheds.

Drainage ditches, he explains, were first built to handle water flooding from croplands. As towns and cities developed, they spread out, building more rooftops and parking lots for the rain to run off, spilling into streets and sewers.

"I study watersheds and how they are affected by rapid development along the coast," he said. "I look at how urban development affects the quantity of runoff from storm events and study ways to mitigate that runoff."

Public officials in Conway and Horry County know it takes brains as well as brawn to prevent the city from flooding. Working with Clemson, Coastal Carolina University, volunteer groups and federal, state and local governments, leaders have restored two sections of the city's main stormwater drainage system.

Dave Fuss, left, Horry County watershed planner, and Anand Jayakaran tour Crabtree Canal.

As a result, Crabtree Canal – once a silt-filled, debris-laden, dead-water drainage ditch – is now on its way to be a model for managing rainwater runoff from roads and roofs in an environmentally sustainable way. Today, after much digging and hauling to rebuild the canal, fish and plants thrive.

The Crabtree project reshaped the ditch and restored the surrounding area to a floodplain, relying on native plants and grasses to slow the flow and filter stormwater. Dug by the U.S. Army Corps of Engineers in the 1960s, the ditch was a classic trapezoid – a U-shaped channel with a flat bottom. Thousands of ditches throughout the world look much the same, but research has shown there is a better design – the two-stage channel.

"When I was in graduate school at Ohio State University, we studied farm ditches," Jayakaran said. "We saw that U-shaped ones collapsed as the water eroded the banks, filling the channel with sediment that had to be removed. Natural streams work differently, carving a channel and building a flat 'bench' that acts like a mini-floodplain in the lower part of the ditch. The two-stage design adds stability and encourages vegetation to grow in the channel.

"The design works in urban areas like Conway, too. Other communities can look at what was done here. It's a way to manage the water, deal with changing conditions and meet environmental regulations."

A stormwater specialist, Jayakaran works with developers, state and county agencies, homeowners and municipal officials to develop ways to reduce runoff. He has been part of the team since 2007, when the partnership began that monitors the Crabtree Canal improvements.

Other Clemson scientists at the Baruch Institute focus on the environmental impact of changing land-use patterns, coastal natural resource conservation, forestry, water quality and watershed management. Research areas include biochemistry, ecosystems, hydrology and data visualization.

On a rare dry day, Jayakaran, Horry County watershed planner Dave Fuss, and Crabtree watershed elected directors George Jenkins Jr. and son Hunter toured the improvements. The Jenkinses are the second and third generations to be involved with flood control.

"We learned a lot about what it takes to plan, build and maintain a project like this," said the senior Jenkins. "A big lesson was to 'let nature run its course' and have the canal work like a stream flowing through a swamp. And it took commitment and coordination from many people and groups to get the project done."

Learn more about research at the Baruch Institute: www.clemson.edu/baruch/

Lever Initiatives fuel a historic legacy of innovation

By Tom Hallman

When South Carolina Congressman and Clemson University trustee Frank Lever crafted the law creating the national Cooperative Extension Service nearly a century ago, he set in motion a radical concept in education: a system to share scientific discoveries with the people who put that knowledge to work.

In the spirit of Lever's vision, Clemson Extension agents are developing innovative educational programs to take the state's economy into the 21st century. Called the Lever Initiatives, these programs offer training and professional certification for South Carolina citizens in areas that enhance sustainable agricultural production and protect the state's water resources.

Distance-Delivered Certificate Programs will provide an umbrella for Extension workshops and training programs to develop "tracks" offering certification in a particular subject area. A team led by Matt Burns designed this approach to serve non-traditional "backyard" farmers who are new to agricultural management and preservation practices, as well as commercial farmers, ranchers and greenhouse industry professionals who wish to expand their knowledge of sustainable production practices.

The Academy for Watershed Excellence will develop a combination of online training and hands-on learning in the state's diverse ecosystems, rivers and marine settings. A team led by Katie Giacalone designed the curriculum to increase technical skills in watershed assessment, restoration practices and protection techniques. The goal is to help developers, contractors, city planners, professional landscapers and industry use practices that prevent pollution in the state's waterways and ponds. The academy includes the following three education programs.

Stormwater Best Management Practice Inspection and Maintenance Certification is tailored for design engineers, stormwater managers, public works staff, commercial landscapers and homeowner associations. A team led by Dan Hitchcock developed the program to prepare municipal workers to meet local codes and state regulations for stormwater management. The training can also spur business opportunities for engineering firms and companies that specialize in property management, pond management and landscape services.

Master Pond Manager is designed to provide comprehensive training in recreation and stormwater pond management. A team led by Guinn Garrett developed this program for pond owners, regulatory agencies, businesses and industries. Interactive lessons will provide a toolset of best management practices to improve pond function and water quality, and protect downstream waterways. State and local agencies that are responsible for issuing stormwater permits can also use these tools.

The Certified Environmental Landscape Professional Program is designed for landscape architects and contractors, lawn-care firms, builders and developers. A team led by Dara Park and Sarah White is developing the curriculum of landscaping best practices to protect natural resources, particularly waterways. The online program will allow working professionals to study on their own schedule. The practices apply to residences, municipal parks, commercial properties and school campuses.

"How to" information for South Carolina and the world

By Tom Hallman

South Carolina farmers have come to Clemson for advice and information since the college first opened its doors. They still do. But now they're joined by senior officials from around the country and the world. Recent delegations from Cambodia, China, and Washington came to learn about Extension, regulatory and research programs for farmers, pesticide applicators and natural resources management.

Cambodia

Three senior Cambodian agriculture officials came to Clemson to learn how to manage a widespread community of small farms through an exchange program with the U.S. Agency for International Development.

"What we learn here, we can adapt to how we work with our farmers," said Heng Chhun Hy, deputy director of Cambodia's Department of Plant Protection.

Cambodia's problem is exacerbated by lack of infrastructure, said Guido Schnabel, a Clemson plant pathologist who has made the trek to Cambodia, along with Meg Williamson, a diagnostician in Clemson's Plant Problem Clinic.

"They are trying to extend this knowledge to a million farmers in remote areas of a country that doesn't have the same infrastructure that we do," Schnabel said. "The challenge is to get information to the farmers who need it."

China

A five-person Chinese delegation came to study Clemson's system of regulating pesticides through an exchange program with the U.S. Department of Agriculture.

"We are specifically interested in the laws, regulations and processes for pesticide application," said He Caiwen, deputy director general of the Department of Crop Production. "We appreciate this opportunity to share information and exchange ideas on best practices."

Joe Krausz, director of Clemson's Department of Pesticide Regulation, led the Chinese team through the system that registers about 14,000 pesticide products and licenses more than 12,000 pesticide dealers and applicators in South Carolina.

"We conduct about 3,000 inspections annually," Krausz told the delegation. "Every product has to have a label, whether it is a small container or a 55-gallon drum."

Washington

Clemson's Intelligent River® research initiative drew visitors from the U.S. Environmental Protection Agency (EPA) and the S.C. Department of Health and Environmental Control (DHEC).

"We are putting in place a network of remote sensors to deliver real-time information on water quality, stormwater runoff, even tree growth, to policy makers and natural resource managers via a website," said Gene Eidson, who leads the Intelligent River research team.

The research fits the needs of sustainable environmental programs that can be an economic driver, said Nancy Stoner, EPA acting assistant administrator for water. "EPA is committed to fostering the use of innovation and technology to advance our common goal of clean and safe water, and projects like Clemson's Intelligent River help address these critical issues," she said.

Catherine Templeton, DHEC director, agreed. "Water is this state's most precious resource. We applaud Clemson for their foresight and innovation in preserving and managing such a vital resource."

Learn more about Regulatory Services at Clemson:
www.clemson.edu/public/regulatory/

Learn more about Clemson's Intelligent River research initiative:
www.clemson.edu/public/psatv/env/intelligent-river-overview.html

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Victory isn't just sweet, it's peachy

By Peter Kent

Victory is sweet. In this case, its flavor is peach crème brûlée.

When Clemson hosted the Peach State's University of Georgia for the first-in-a-decade gridiron meeting in August, South Carolina peaches were the main ingredient in special treats served in Memorial Stadium's executive suites.

"The idea really blossomed last spring when we worked with Aramark, which has the campus food-service contract, to supply Clemson-grown peaches in dining halls," said Jeff Hopkins, manager of the university's Musser Fruit Research Farm.

"We were tossing around ideas and we came up with it: Let's serve our peaches at the football game," said Peter Barone, Aramark's senior food service director at Clemson.

Aramark pastry chef Cicely Austin decided to forego traditional peach pie or cobbler.

"I knew I couldn't do better than the recipes that are family traditions," said Austin, a Culinary Institute of America-trained chef. "I decided on peach crème brûlée that we chill overnight and top with dollops of whipped cream, fresh peaches and sugar cookie crisps."

She prepared the caramelized custard dessert from Redhaven peaches grown at the Musser Farm, which enables scientists to produce disease-resistant root stock and to test new varieties of peaches and other fruits.

Redhavens are freestone peaches, golden yellow with a red blush, that grow well in many climates and are a mainstay of the peach industry and a research standard.

Beyond the gridiron, the Clemson-Georgia rivalry reached to the roots of state identity: the peach. Georgia claims the moniker "The Peach State," but South Carolina grows more than twice as many peaches.

South Carolina farms produced 75,000 tons of peaches on 17,000 acres in 2012, generating $74 million, according to the U.S. Department of Agriculture. Georgia contributed 33,300 tons from 9,900 acres for a total of $29 million.

Find out more about the Musser Farm: www.clemson.edu/public/researchfarms/musser_fruit_farm